

SECOND IN A SEQUENCE OF PRACTICAL INQUIRIES
INTO MAGNETIC DATA RECORDING ... by

FERRROXCUBE

CORPORATION OF AMERICA

SAUGERTIES, NEW YORK

RECORDING HEADS

**WHAT'S YOUR
BIT-CAPACITY LIMITATION
- STATE-OF-THE-ART,
OR HOLE-IN-THE-HEAD?**

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12603

1-6



This is the second of six. Each of these short monographs is written to focus your attention on one feature of a new generation of recording heads manufactured by the unique, patented Ferroxcube "all-glass-bonded" process. The first was entitled "Are you recording with a HEAD ... or a BOTTLENECK?"

As we mentioned in the first of this series, we address these messages to you because we understand you to be directly and responsibly involved in the engineering, management, or marketing decisions that determine your company's choice of data-recording techniques and equipment.

If you are not, in fact, the logical recipient of this message, won't you accept our invitation to use the enclosed card to redirect our efforts? We'll "catch him up" by return mail, and not divert you further.

Now for today's question—

WHAT'S YOUR BIT-CAPACITY LIMITATION — STATE-OF-THE-ART, OR HOLE-IN-THE-HEAD?



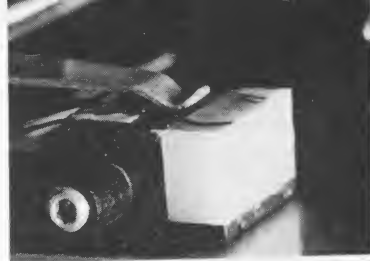
There is an easy way to tell: Check if you could (and would) use a higher bit density per track, or a higher track density per inch — if the characteristics of the recording head made them possible.

Then, with the *same* amount of electronics, and the *same* mechanism, you could store *more* bits per square inch of recording medium, *more* bits per second, and — very important — *more bits per dollar* of recording-equipment investment.

All of these advantages are inherent in the properties of a Ferroxcube all-glass-bonded head, because . . .

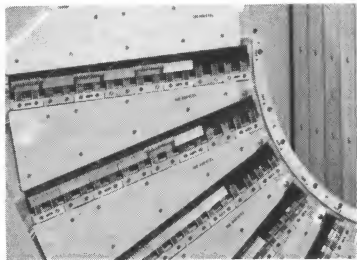
FIRST OF ALL, WITH AN ALL-GLASS-BONDED HEAD, YOU CAN SQUEEZE DOWN EVERY CRITICAL DIMENSION . . . WITH CONFIDENCE. Gap length, gap height, track width, track spacing. . . all can be smaller, with a consequently higher bit density.

IN FLYING DISC HEADS. For example, you can afford to "fly lower" then you would dare to do with any other kind of head. The all-glass-bonding process makes possible such a fine finish that you could almost say the high degree of aerodynamic stability is inherent in the process.

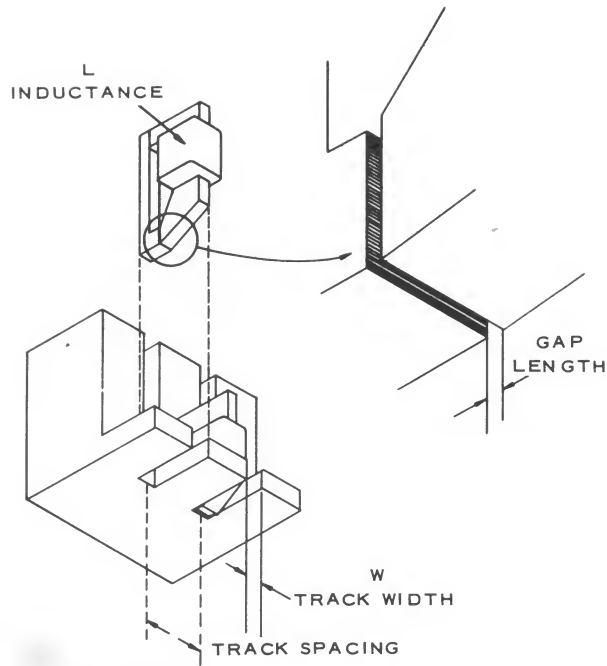


YOU NEED NOT WORRY — EVER about catastrophic "dive-in" failures, such as are common in epoxy-bonded and other types of head designs. . . you need never fear a catastrophic loss of one or more complete discs and head assemblies. Maintenance cycles are far longer, therefore, with an all-glass-bonded head.

The dimensions of the flying heads for this large disc memory are so accurately controlled, for example, that the designers were able to specify a gap-length of 200 microinches and a flying distance of less than 100 microinches, making possible a packing density of almost five times that previously considered a maximum with conventional heads!



DESIGN FLEXIBILITY. Because the all-glass-bonding technique employs a high performance ferrite material, and because it is not limited to any particular size or configuration of core, the designer is given far greater freedom in specifying the recording format he wishes to employ. Both the gap spacing and the head spacing may be varied over wider ranges using this technique, than has ever been possible with conventional designs.



HERE ARE THE FUNDAMENTAL

Fundamental Dimensional Relationships.

The drawing to the left indicates the fundamental dimensions that determine the performance—and, hence, the design — of a “flying head”. Note that the relationships between these critical dimensions and the head performance are given by

$$\text{Read-out voltage} = k_1 n W$$

where n = number of turns per winding

and W = track width

$$\text{Inductance } L = k_2 n W v$$

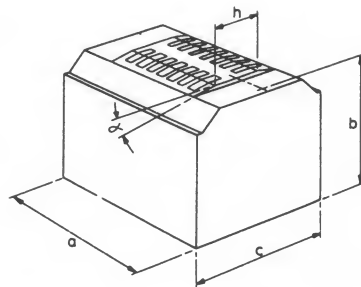
where v = velocity

$$\text{Drive } i \approx \frac{K_3 H}{n}$$

TECHNICAL RELATIONSHIPS INVOLVED...

Read-To-Write Relationships.

As illustrated here, certain dimensions and tolerances must be applied to multiple-head assemblies in which the read/write function is provided — whether in a unit assembly, or in a pair of assemblies. Note that this set of specifications is actually derived from the basic data format planned for the system.



Head-To-Head Dimensional Relationships.

Equally as important as the fundamental head-to-medium relationships are the dimensions and tolerances that relate one head to another in a multi-head assembly. These include: head *spacing* (distance between gap centerlines); head *separation* (distance between facing magnetic surfaces of adjacent cores); track width; gap length; and, of course, at least an estimate of gap alignment requirements.

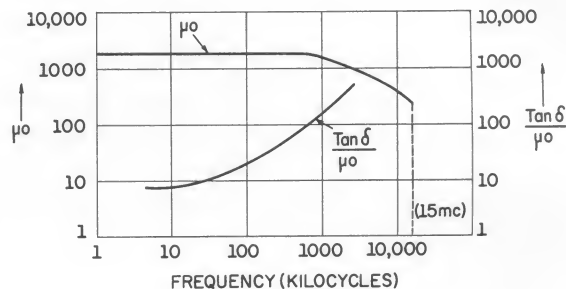
HERE'S HOW FERROXCUBE ALL-GLASS-BONDED RECORDING HEADS ARE DESIGNED AND MANUFACTURED...

THE DESIGN may begin in either of two ways:

- You may prepare a complete electrical, magnetic, and mechanical specification, and then have us provide an equivalent all-glass-bonded design.
- You may merely state the head-to-medium spatial relationships, specify the limiting electromagnetic properties of the medium, and describe the input-output signals and interfaces. . . and let us write an equivalent specification.

FERROXCUBE 4R5 is the core material used in all-glass-bonded recording heads. It is unique in having chemical, thermal, and mechanical characteristics that are fully compatible with the special glass used to bond the head assembly; this unique formulation sacrifices very little in either its electrical or magnetic properties to achieve that compatibility, as the graph shows. These parameters are very accurately controlled.

**ALL-GLASS-BONDED
HEADS ARE MADE BY
A HIGHLY-DEVELOPED
FIVE-STEP PROCESS**

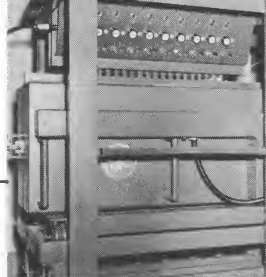




Precision Core Grinding . . . Ferroxcube ferrite facilities are unequalled anywhere in the world.



Quality-Assured Precision Assembly . . . Ferroxcube's new assembly line operates under the most rigid quality controls in the industry—from the ultimate security of 100% in-plant manufacture of all critical elements to the maintenance of "white-room" environments for all critical assembly operations.



Unique Glass Bonding Facility . . . Ferroxcube's all glass-bonding technique is an exclusive process.



Micro-Finish and Testing . . . Ferroxcube has developed completely new micro-finishing techniques compatible with the new higher dimensional - control standards made possible by all-glass bonding, and testing techniques, compatible with the 1.7 microinch RMS surface finish achieved on all standard heads.

Precision Winding . . . Ferroxcube's modern winding facility employs the most modern fine-wire winding features and techniques currently available.



IN SUMMARY, THEN, WE MAY SAY

that the specific advantages of Ferroxcube All-Glass-Bonded Recording Heads that let you achieve more bit capacity are:

- more bits per track
— due to better gap definition and smaller gap height
- more tracks per inch
— due to better control of very small track widths
- higher bit density for the same electronics
— because bit density is bits/track $\times$ tracks/inch
- more flux density per watt of power
— due to lower losses, shorter flux paths
- more bits per dollar of recording-equipment investment
— because higher bit density means more bits/square inch/second — with *no* increase in electronics!



**THESE
EXAMPLES
WILL SERVE
TO ILLUSTRATE
THE RANGE
& VARIETY
OF HEADS
WE NOW
MANUFACTURE...**

FIRST CLASS
PERMIT NO.
50
SAUGERTIES, N. Y.

BUSINESS REPLY MAIL

No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY —

FERROXCUBE

CORPORATION OF AMERICA

SAUGERTIES, NEW YORK

**ATTENTION
RECORDING-HEAD
APPLICATION ENGINEERING
DEPARTMENT**

Gentlemen:

I read you, loud and clear, and here's my reaction:

- ☐ I believe you have reached my boiling point—have one of your application engineering group call me for an appointment, before I build up excessive pressure.
- ☐ I'm thawing. Send over one of your fire-breathing field engineers. (Have him call for an appointment, first.)
- ☐ I'm far from convinced—hardly warm, in fact—but I can't afford to ignore all-glass-bonding any longer. Send me your brochure, and any other fuel you wish to throw on the fire.

☐ Here's my Name _____ and Title _____

my Company _____

and Division _____

Street Address _____

City, State, Zip _____

☐ You're talking to the wrong party. Try your pitch on:

Name _____ Title _____

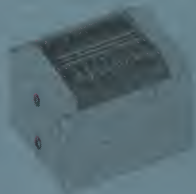
☐ At the Above Address or ☐ At: _____



◀ 7-Channel Read-Write
Contact Analog Tape
Head.



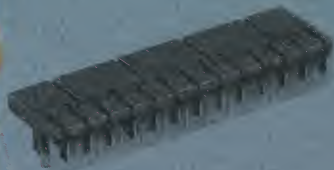
Digital Contact Head for a
"Magnetic-Stripe-Reader"
Used in Business-Machine
Applications. ▶



◀ 7-Track Digital Head. The
standard final finish is held
to 1.7 microinches, RMS,
and this finish is main-
tained to within 2 micro-
inches over thousands of
hours of use.



8-Track Analog Head for
a Tape Transport. ▶



◀ 13-Unit Assembly of Flying
Disc File Head.

**HOW
ABOUT
YOUR
MAGNETIC
RECORDING
SYSTEMS?
ISN'T IT
TIME WE
PUT OUR
HEADS
TOGETHER...?**

FERROXCUBE

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SAUGERTIES, NEW YORK



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